THE CURRENT FEATURES OF PYELONEPHRITIS CAUSAL STRUCTURE IN CHILDREN

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Summary: *239 cases of pediatric pyelonephritis and the current features of its causal structure, susceptibility and resistance of uropathogens have been analyzed. It allows to prescribe an initial rational antibacterial therapy.*

Key words: *children, pyelonephritis, causual structure, antibacterial therapy*

Pyelonephritis is one of the leaders in the structure of nephropathy in children and adults, the number of pyelonephritis cases has recently increased. The possible reasons for that are both: improved diagnosis of the disease with the use of modern research methods and the increasing prevalence of dysmetabolic disorders, dysbacteriosis, allergization of the population.

The seriousness of the prognosis, diagnosis and treatment difficulties determine the relevance of the problem of pyelonephritis and require the knowledge of current regional data on the age structure of inoculated uropathogens depending on the identified pathology. Analysis of these data provides a basis for correction of empirical and causal treatment of the disease [1, 5, 6].

The causative agents of pyelonephritis most commonly are bacteria found in the intestinal tract that form its normal microflora. Most often it's Escherichia coli and Enterococcus, as well as Proteus, Klebsiella, and others [2, 3, 4].

In most cases, the bacteria enter the kidney through ascending path. Hematogenic route of infection is typical for infants. The possibility of lymphatic spread of infection is related to the anatomical proximity of the lymphatic system of the intestinal tract and urinary system, but it requires study. There are acute and chronic, primary and secondary types of pyelonephritis. Secondary pyelonephritis can be obstructive and non-obstructive (eg dysmetabolic). Disorder of physiological urine flow in the right direction may be caused by anatomical defects of the structure of urinary tract and kidneys, disorder of their innervation, formation of vesicoureteral or kidney reflux, the deposition of salt crystals in the renal tubules, and by other reasons, the number of which increases with the improvement of diagnostic features.

Among the reasons that predispose to pyelonephritis are diseases of the digestive system, accompanied by the development of intestinal dysbiosis, the presence of persistent infection foci, immune dysfunctions, and immunodeficiency states [1, 2].

The aim of the work was to study the diclosure and the structure of uropathogens in patients with acute and chronic pyelonephritis in the age aspect, depending on sex, disease activity, the nature of associated pathology**.**

Materials and methods. Medical records of children discharged in 2013 from the nephrology department of Dnipropetrovsk Children's Clinical Hospital №2 with a di-

agnosis of acute or chronic pyelonephritis were analyzed. We conducted urine culture from the middle portion for all the children, followed by the identification of the causative agent and determination of its sensitivity to antibiotics. Among the 239 children, aged from 1 year to 17 years, the positive results of urine culture were obtained from 100 children, 70 girls and 30 boys. The average age of these children was 10.3 ± 2.4 years.

16 children were diagnosed with active pyelonephritis, 84 children were diagnosed with chronic pyelonephritis in remission. All the children who participated in the study had a thorough clinical, laboratory and instrumental examination according to the order of the Ministry of Health of Ukraine from 03.11.08 №627. Clinical and laboratory examination included an overall analysis of blood, urine, urine methods of Nechyporenko, Zimnitskiy, determination of daily proteinuria, biochemical blood test with determination of level of urea, creatinine, glomerular filtration rate (the Schwartz formula), crude protein, blood glucose. Ultrasound investigation of patients' kidneys and bladder was also conducted.

Depending on the indications, radiological methods of investigation, such as voiding cystography and excretory urography, immunological research, bacteriological examination of feces were conducted, children were consulted by doctors of related professions — by otolaryngologist, gynecologist, neurologist, cardiologist, endocrinologist, and others. The main group consisted of 100 children with pyelonephritis who had positive urine culture. Uropathogens spectra have also been examined depending on the age, gender, urodynamics, concomitant diseases of the digestive system, the presence of infection foci in nasopharynx.

Results and discussion. Sterility urine test showed that opportunistic pathogenic microflora was detected in 100 out of 239 children. Inoculation of microorganisms from reached 41.8%. E. coli was detected in 43 out of 100 children, E. faecalis — 34 children, K. pneumoniae 8 children , Proteus — 6 children, S. aureus — 4 children, P. aeruginosa — 3 children, S. haemolyticus — 2 children. Microbial associations were detected in 2 children, there were E. coli and Enterococcus.

Among the children examined, only 7% were under the age of 3. Talking about the age aspect, an infant tendency to relative increase of Proteus (14.3%) and Pseudomonas aeruginosa (28.5%) exposure frequency draws attention. Boys' ratio of E. coli and enterococcus was, respectively, 16.7% and 56.7%, that was different from girls' ratio (54.3% and 24.3%, respectively).

As we can see from a table 1, pyelonephritis activity is associated with an increased proportion of Pseudomonas aeruginosa and Proteus, while the relative role of representatives of normal intestinal microflora — Escherichia coli and Enterococcus is reduced.

While carrying out the research we paid attention to the presence of concomitant diseases, both on the part of the urinary system, and other organs and systems. Urodynamics disorders may be explained by different reasons. Obstructive uropathies in literature are usually associated with vesicoureteral reflux, renal hypoplasia and aplasia, complete doubling of kidneys, its lumbar dystopia, hydronephrosis. We had 23% of such children in our research. Among them, E. coli was marked from urine most often

Table 1.

Uropathogens structure of children with acute and chronic pyelonephritis

Microflora profile	Main group		Active pyelonephritis		Inactive pyelonephritis (remission)	
	abs.	%	abs.	%	abs.	%
E. coli	43	43.0	6	37.5*	37	44.0
E. faecalis	34	34.0	4	25.0*	30	35.7
K. pneumoniae	8	8.0	1	6.3	7	8.3
Proteus	6	6.0	2	12.5*	4	4.8
S. aureus	4	4.0	-	-	4	4.8
P. aeruginosa	3	3.0	3	18.7*	-	-
S. haemolyticus	2	2.0	-	-	2	2.4
Total	100	100.0	16	100.0	84	100.0

* — differences with the main group are reliable ($p<0.05$)

(47.8%) the second most important uropathogen was Enterococcus (26.7%). More often than in the main group, children with disorder of urine passage had Pseudomonas aeruginosa — (8.7%). Dysmetabolic nephropathies were detected in 34 out of 100 children. In this group of children, on the contrary, Enterococcus took the lead among uropathogens (41.2%), Escherichia coli came in second — 38.2% (Table 2).

Table 2.

Uropathogens structure of children with secondary pyelonephritis

Microflora profile	Main group		Urodynamics disorder		Dysmetabolic nephropathy	
	abs.	%	abs.	%	abs.	%
E. coli	43	43.0	11	47.8	13	38.2
E. faecalis	34	34.0	6	26.5*	14	41.2*
K. pneumoniae	8	8.0	2	8.7	2	5.9
Proteus	6	6.0	2	8.7	1	2.9
S. aureus	4	4.0	-	-	3	8.8*
P. aeruginosa	3	3.0	2	8.7*	-	-
S. haemolyticus	2	2.0	-	-	1	2.9
Total	100	100.0	23	100.0	34	100.0

* — differences with the main group are reliable ($p<0.05$)

When examining 22 children with pyelonephritis and infection foci in nasopharynx, E. coli was detected in 27.3% of children (n=6), E. faecalis — 45.5% (n=10), S. aureus — 18.2% (n=4). Comparison of these children microflora with the microflora of children from the main group shows a heavy increase of S. aureus proportion.

In case of pediatric pyelonephritis with concomitant dysbiosis in the setting of lesions of the gastrointestinal tract (gastritis, gastroduodenitis, irritable bowel syndrome, colitis nonulcerated) Escherichia coli (58.4%) and Proteus (16.7%) were the leaders (Table 3).

Table 3.

Uropathogens structure of children with concomitant diseases

Microflora profile	Main group		Intestine dysbacteriosis		Infection foci in nasopharynx	
	abs.	%	abs.	%	abs.	%
E. coli	43	43.0	7	58.4*	6	27.3**
E. faecalis	34	34.0	4	8.3**	10	45.5*
K. pneumoniae	8	8.0	1	8.3	-	-
Proteus	6	6.0	2	16.7*	1	4.5
S. aureus	4	4.0	-	8.3	4	18.2*
P. aeruginosa	3	3.0	3	-	-	-
S. haemolyticus	2	2.0	-	-	1	4.5
Total	100	100.0	12	100.0	22	100.0

* — differences with the main group are reliable ($p<0.05$)

**- differences with the main group are reliable ($p<0.001$)

Depending on the detected microflora an individual causal treatment is chosen, on the basis of data on the sensitivity of bacteria to antibiotics. We performed a sensitivity and stability analysis of the most frequently detected uropathogens — Escherichia coli and Enterococcus. The spectrum of their sensitivity is not equal.

The high sensitivity of E.coli to Ceftriaxone, Amoxiclav, Norfloxacin and Furagin was discovered, while sensitivity to Ciprofloxacin, Gentamicin, Fosfomycin was less than 3%.

Enterococcus faecalis is the most sensitive to Vancomycin, Ampicillin, Furagin, Fosfomycin, and least sensitive to Ceftriaxone.

Conclusions. According to the results of the research microbial inoculation from the urine of children with pyelonephritis is 41.8%. Leading uropathogens in pediatric pyelonephritis are E. coli (43%) and E. faecalis (34%).

The spectrum of opportunistic pathogens extracted from urine differed depending on the age, sex, comorbidity, which should be considered when selecting empiric therapy. So, Enterococcus was found in boys' urine much more often than in girls' one (56.7% and 24.3%, respectively). Early children age, the activity of pyelonephritis, the presence of obstructive pyelonephritis were associated with an increase of the proportion of E. coli, Pseudomonas aeruginosa and Proteus.

In case of dysmetabolic nephropathy, intestinal dysbiosis, presence of infection foci in nasopharynx, the change in the uropathogens spectrum took place in favor of Enterococcus, the relative frequency of S. aureus increased.

E. coli is most sensitive to Ceftriaxone and Amoxiklav, but is not sensitive to Ciprofloxacin, Gentamicin, Fosfomycin, while Enterococcus faecalis is not sensitive to Ceftriaxone, but is highly sensitive to Vancomycin and Ampicillin, so the efficiency of different groups of antibiotics, depending on gender, age, activity of pyelonephritis and comorbidity, varies.

Literature:

1. Возианов А. Ф., Майданник В. Г., Бидный В. Г., Багдасарова И. В. Основы нефрологии детского возраста. Киев: Книга плюс, 2002. С. 22–100.

2. Эрман М. В. Нефрология детского возраста в схемах и таблицах. СПб.: Специальная литература, 1997. С. 216–253.

3. Thomas B. Newman. The New American Academy of Pediatrics Urinary Tract Infection Guideline // Pediatrics. — 2011. — Vol. 128. — P. 572.

4. Williams G., Craig J.C. Long-term antibiotics for preventing recurrent urinary tract infection in children // Cochrane Database of Systematic Reviews. — 2011. — Vol. 3.

5. Urinary tract infection in children: diagnosis, treatment and long-term management. NICE guideline. — London (UK): National Institute for Health and Clinical Excellence, 2007. — 30 p.

6. Thomas B. Newman. The New American Academy of Pediatrics Urinary Tract Infection Guideline // Pediatrics. — 2011. — Vol. 128. — P. 572